(The following comments were received after the Public Hearing documents were sent out on January 17, 2006. These comments and Board staff's recommended changes to the proposed Basin Plan amendment are also addressed in the April 21, 2006 supplemental staff report.)

TIM MOORE
Risk Sciences
Letter presented on February 14, 2006

Note: Comments were provided on behalf of the Big Bear Lake TMDL Task Force, with the exception of the USFS.

Comment #1
Revise language of staff report to indicate that external load dischargers are responsible for "some" of the internal load. Change text from saying that they are responsible for reducing "the" internal loads to "they are responsible for reducing their internal loads."

Response #1
Staff have revised Finding #14 of Resolution No. R8-2006-0023 to include language reflecting that the external load dischargers are responsible for reducing their contributions to the internal nutrient loads.

Comment #2
Delete the example calculation of natural background loads. Without an agreed definition as to what constitutes "natural background," such calculations are premature. The example significantly underestimates the natural background loads.

Response #2
The example calculation was presented for informational purposes only in the January 17, 2006 Staff Report. This Report is a part of the record of this matter and is not subject to change. As indicated in the January 17, 2006 staff report, the example is **one** method for determining natural background loads and staff noted that much more data would be needed to refine the calculation. This example calculation is by no means the only method for determining natural background loads.

Comment #3
Change target for Percent Aquatic Macrophyte Coverage to range between 10-30% of the littoral zone as recommended in the revised Leidy report.

Response #3
Staff does not agree with this recommendation, but now proposes that the macrophyte coverage target be changed from 30-60% to 30-40% on a whole lake basis. The basis for this recommendation is as follows.

As noted in the Response to Comments released on January 17, 2006, staff used the recommendation for macrophyte coverage initially provided by Leidy to identify the proposed 30-60% coverage target. In the June 2003 document titled "Prehistoric and Historic Environmental Conditions in Bear Valley, San Bernardino County, California", Leidy (2003b, 37) states "More than 60 percent of the reservoir bottom area potentially

supports aquatic macrophytes (over 1,800 acres of the 2,973 acre reservoir area at full pool)." In an email dated July 2, 2003 to Sheila Hamilton and Tim Moore, staff asked (Boyd, 2003) "Would a coverage closer to 60% be more applicable based on this report?" This question was directed to Leidy, who, in a reply dated July 21, 2003 (Leidy, 2003a), stated "The short answer is "yes,", if "applicable" means *what would naturally occur in Big Bear Lake in the absence of development in the watershed and in the absence of human manipulation.*" He then states "To maintain the aquatic fauna of the reservoir in a reasonable balance, I would not recommend reducing the macrophyte coverage to less than 30 percent. A relatively even distribution of macrophytes around the perimeter of the lake is also desirable, if not prevented by topography."

In the final version of Leidy's report, dated February 2006 (Leidy, 2006b), Leidy states that "…aquatic macrophyte coverage about 10 to 30 percent of the lake's littoral area capable of supporting aquatic macrophytes should be adequate to maintain aquatic ecosystem functions and to maintain a viable largemouth bass population", and "adverse impacts to the bass population are potentially possible if the aerial coverage at Big Bear Lake begins to exceed about 30 percent of the littoral area." In response to a query from Board staff concerning the apparent change in his coverage recommendation, Mr. Leidy replied (Leidy, 2006a) that his recommendation had not changed but that the final report simply clarified the draft report by explicitly referring to the littoral zone as the area to be considered in establishing the coverage target. Mr. Leidy concluded that macrophyte coverage from 10 to 30 percent of Big Bear Lake's littoral area (i.e., photic zone) will maintain all aquatic ecosystem functions.

After reviewing the final version of Leidy's report and consideration of additional literature and information (Anderson, 2006; Petr, 2000; Schneider, 2000), staff are not convinced that the range of macrophytes should be lowered to less than 30% or that macrophyte coverage should be based on the littoral area for the following reasons.

1) The littoral zone is difficult to quantify. Whole lake coverage can be normalized to the area of the lake at full pool so that macrophyte coverage can be compared even when lake levels differ. Staff notes that none of the references cited in the Leidy report (Leidy, 2006b) explicitly refers to the littoral zone.

- (Leidy, 2006 b, p.48) – Orville P. Ball and Associates (1987) suggested that a plant coverage of 12 to 22 percent of the lake would likely be suitable if fishing were the principal recreational activity on the lake
- (Leidy, 2006 b, p.51) – In a survey of 30 Texas reservoirs Durocher et al. (1984) found a highly significant, positive relationship between the percent submerged vegetation (up to 20 percent)…
- (Leidy, 2006 b, p.51) – The Florida Game and Fresh Water Fish Commission suggested that 30 percent plant coverage represents a healthy balance for warmwater fish in small water bodies.
- (Leidy, 2006 b, p.51) - In large lakes (i.e., greater than 133 surface acres), young-of-the-year largemouth bass density was positively correlated to percent area coverage (PAC) of aquatic macrophytes and to PVI (percentage of the lake volume infested) (Maceina 1996).
- (Leidy, 2006 b, p.52) - Similar research in Guntersville Reservoir, Alabama, by Wrenn et al. (1996) evaluated the fluctuating surface

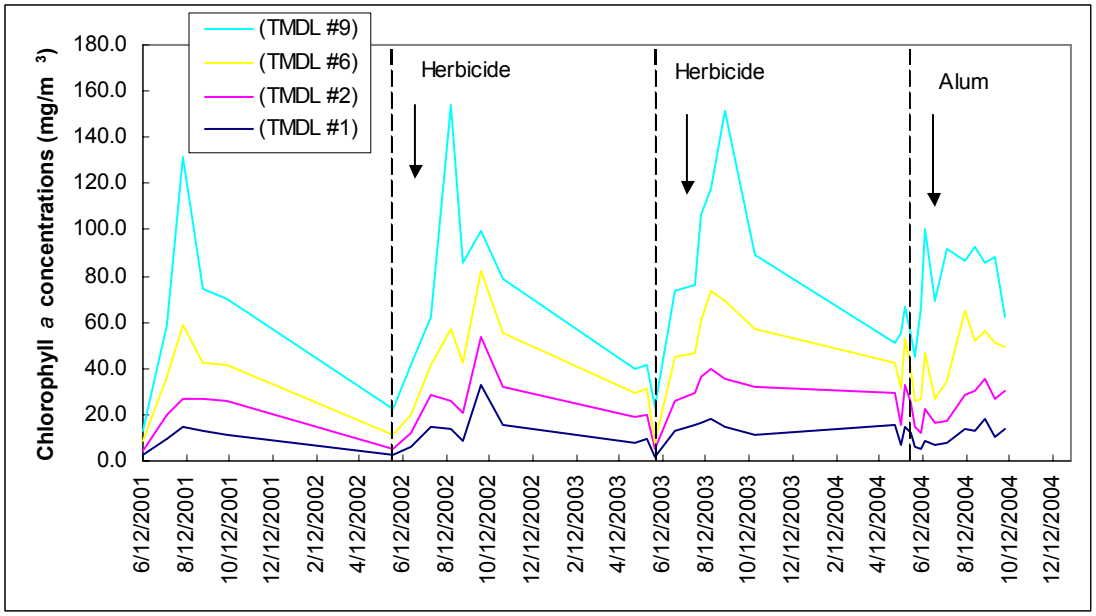
coverage of aquatic macrophytes over a period of years. These researchers concluded that an optimum level of macrophyte coverage could not be identified for largemouth bass, but coverage of greater than 20 percent of the surface area contributed to a decline in growth for fish younger than age-4.

- (Leidy, 2006 b, p.52) – "The "best science" indicates that 10-40% aerial coverage of submersed plants may be ideal for largemouth bass fisheries in larger water bodies" (Maceina 1999).

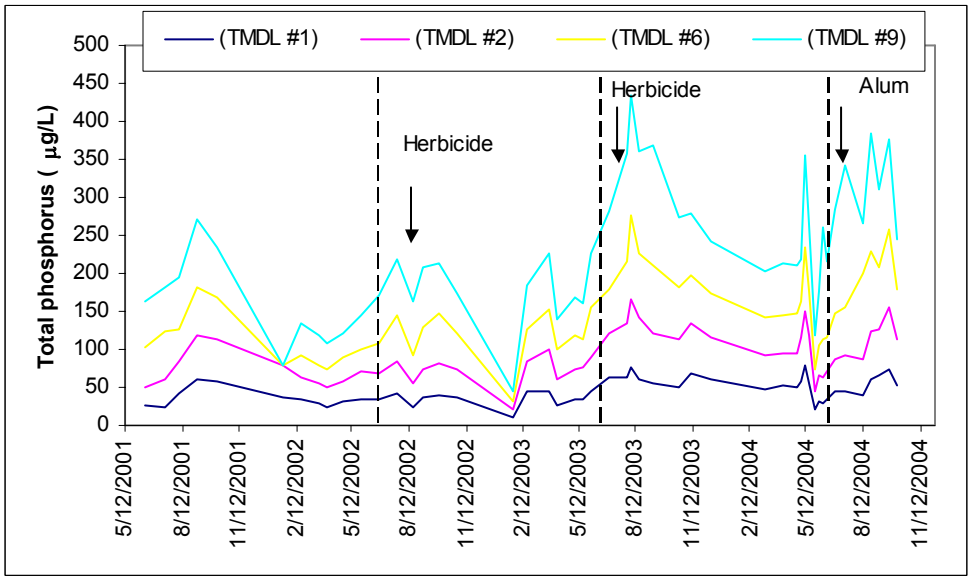
2) Staff are concerned that the literature cited by Leidy (2006b) provides evidence pertaining to macrophyte coverage to support fisheries alone, and that other beneficial uses of the lake are not taken into consideration. Empirical evidence demonstrates that macrophyte coverage reductions on the order proposed by Leidy (and the 60% upper limit of the range initially proposed by Board staff) could have adverse effects on lake water quality and beneficial uses.

The herbicide treatments conducted in 2002 and 2003 eradicated more than 50% of the total area of macrophytes (414 of 781 acres), while changes in lake levels also contributed to an additional decrease in plant coverage over this time. Subsequent to the herbicide treatments and prior to the alum treatment in May 2004, water quality conditions in Big Bear Lake were poor, characterized by high nutrient levels and excessive algae (see Figures 1 and 2 below). Excessive algae growth violates the Basin Plan narrative objective for algae and adversely affects the recreational and wildlife beneficial uses of the lake. In part, the poor water quality conditions and algae growth can be attributed to the reduction of macrophytes that would otherwise have utilized nutrients in the water column and thereby prevented or reduced algae growth. Obviously, a balance must be struck amongst acceptable macrophyte growth, nutrient concentrations and algae growth in order to assure that all of the beneficial uses of the Big Bear Lake are protected.

The algae blooms following the herbicide treatments were reflected by high chlorophyll *a* values, shown in the graph below. These chlorophyll *a* values generally exceed the proposed chlorophyll *a* target (14 µg/L as a growing season average), which is intended to assure that the growth of algae does not become excessive.



Data plotted only for growing season (May 1 –October 31) for each year (2001-2004). Site numbers increase from west to east: Site #1 =west end, Site #9 =east end.



Data plotted for 2001-2004 for all months in which there were data available
Site numbers increase from west to east: Site #1 =west end, Site #9= east end

Staff calculated the approximate areas of macrophytes that would be expected based on the different recommended targets.

Percent coverage	Whole lake area (acres)	Littoral area (acres)
10-30	274-822	187-560
30-40	822-1096	560-747
30-60	822-1644	560-1120

Assumptions:
1)Lake is at full pool at 2740 acres (Tetra Tech, Inc. 2004)
2)Littoral area is from 0-18 feet below the lake surface (plants are found in Big Bear Lake to about 18 feet below the water surface but the distribution of plants depends on factors besides depth, such as slope, substrate, clarity, etc.)
3)Littoral area is equal to 1867 acres (Tetra Tech, Inc. 2004) (as pointed out above, littoral area is approximate and is difficult to quantify –for the purposes of these calculations only, staff is simplifying by using depth only as the determining factor in littoral area).
4) Remetrix (2001) stated that in 2000 approximately 800 acres of the lake was comprised of macrophytes. This acreage translates to approximately 29% and 43% coverage on a whole lake and littoral area basis, respectively.

Example Calculations:
Whole lake area:
30% = 0.3*2740 acres = 822 acres
Littoral area:
30% = 0.3*1867 acres = 560 acres

Staff continues to recommend that the macrophyte coverage target be based on whole lake area but now proposes a 30-40% target range. Although the lake bottom can support up to 60% coverage of plants, coverage to that extent would probably result in the significant adverse impacts to the beneficial uses of the lake. This recommendation appears to be consistent with other recommendations in the literature regarding optimal macrophyte coverage (Anderson, 2006; Petr, 2000; Schneider, 2000). Staff recognizes that the coverage of macrophytes now proposed is essentially the same as the coverage that existed when the lake was placed on the 303(d) list in 1994. However, in 1994, the macrophyte population consisted of nuisance species, not a diverse community and the location and density of these plants resulted in adverse impacts to the lake's beneficial uses. As discussed in the Technical Report for the Nutrient TMDL, the intent of the macrophyte coverage target is to assure the presence of a diverse community of plants that can provide aquatic habitat (and that can reduce water column nutrient concentrations and excessive algae growth). Macrophytes can be managed so that plant density within the lake is a function of the type of beneficial use. This type of management would allow the macrophyte coverage on a whole lake basis to remain essentially unchanged, but would allow for variations in plant density dependent on type of beneficial use expected for that location. It should be emphasized that the proposed Basin Plan amendment requires the development of a lake management plan that takes into account vegetation metrics. Assessments of the relationships between fisheries, water quality, macroinvertebrates and coverage of macrophytes will be an important part

of the development of this plan and will likely lead to recommendations regarding optimal macrophyte coverage. The targets/TMDL can be modified if and as necessary to address these recommendations.

Comment #4
Delete the compliance date for wet or average conditions. A compliance date cannot be approved until a TMDL and Implementation Plan are available to know what is required to comply.

Response #4
Staff have added a footnote to Table 5-9a-c in the Attachment to Resolution No. R8-2006-0023 specifying that the proposed compliance dates for wet and/or average hydrological conditions are subject to change based on approved TMDLs for those hydrological conditions.

Comment #5
WARM and COLD are "designated" uses not "existing" uses. Existing uses are those that have been attained since November of 1975. The definition of attainment is that water quality standards have been consistently met. Water quality objectives cannot be revised to be less stringent if these are "existing" uses.

Response #5
Staff has revised Finding 7 in Resolution No. R8-2006-0023 to refer to the "designated" beneficial uses of Big Bear Lake. The proposed TMDL is intended to protect these uses, whether or not they are considered "existing".

As a factual matter, it is appropriate to point out that, as Risk Sciences, Inc. recognizes, there is diversity of opinion among regulatory agencies and other stakeholders concerning the definition of attainment. The USEPA and the State Board (in precedential decisions) have defined "existing uses" as those that actually occurred as of November 28, 1975 **or** where the water quality was suitable to support such uses.

Further, we believe that Risk Sciences, Inc. incorrectly assumes that "existing use" determinations prohibit refinement of beneficial use classifications and the adoption of appropriate water quality objectives. USEPA encourages states to refine beneficial uses and to adopt water quality objectives tailored to assure protection of those uses. Even if there is no refinement of beneficial uses and a COLD (for example) beneficial use is determined to be "existing", less restrictive objectives could be developed provided that it is demonstrated that (1) the COLD use will be fully protected, and (2) that antidegradation requirements are satisfied. This flexibility is reflected in Task 7 of the proposed Basin Plan amendment. This task specifies the review/revision of Big Bear Lake Water Quality Standards, which includes tasks to review/revise nutrient water quality objectives, develop biocriteria and develop a definition of natural background.

Comment #6
Modify statement that reducing nitrogen and phosphorous is "necessary" to meet narrative water quality standards for algae, weeds and dissolved oxygen. There are lake management strategies to improve some or all of the response targets without necessarily reducing nitrogen and/or phosphorous concentrations. Regional Board cannot specify the method of achieving compliance.

Response #6
Staff have revised the language in the proposed Resolution (Finding # 10) to specify that control of phosphorus is one of the potential methods to ensure compliance with relevant numeric and narrative water quality objectives specified in the Basin Plan, and to prevent adverse beneficial use impacts resulting from the proliferation of nuisance aquatic plants.

Comment #7
Margin of safety for nutrient targets is unnecessary given the degree to which the response targets are being attained by other control measures.

Response #7
A margin of safety is a required component of a TMDL, as specified in [CFR Title 33, Chapter 26 Section 1313(d) (1) (C). As explained in the June 2005 staff report, staff used an implicit margin of safety that accounts for uncertainty in the TMDL.

Comment #8
Chlorophyll-a target is expressed as an annual growing season average. Using 14 ppm will result in non-compliance in half the years despite the fact that algae are not impairing beneficial uses in those years.

Response #8
Staff assumes that this comment is directed at the median or 50th percentile value used to set the proposed numeric target of 14 µg/L. The assertion that use of this target will result in significant noncompliance apparently relies on the premise that observed water quality conditions in the lake will continue and that no nutrient control or other TMDL implementation activities to improve those conditions will be implemented. It is simply inappropriate to rely on data now available to conclude that the target cannot be achieved consistently. As described in the Technical Report for the Nutrient TMDL, model simulations demonstrated that the proposed chlorophyll *a* target can be achieved if other actions to achieve the TMDL (phosphorus reduction, reductions in macrophyte coverage) are implemented.

Comment #9
Targets should be adjusted for falling lake levels. Evaporation increases nutrient concentrations by up to 100% during a drought cycle.

Response #9
The WASP lake model did account for changes in lake levels and corresponding changes in water quality concentrations (based on empirical data from 2001-2003), therefore, the load reductions that are needed to meet the proposed numeric targets already take these factors into consideration.

Comment #10
There is a strong possibility that EPA will line item veto the “Weight-of-Evidence” approach based on their long-standing commitment to the “Independent Applicability” approach. If they do so, the entire basin plan must be brought back to the Regional Board for reconsideration.

Response#10
Staff of USEPA have not raised objections to the proposed language (included in the proposed Basin Plan amendment in Section 1. A. Numeric Targets) regarding the use of the weight of evidence to determine whether or not compliance with the TMDL is being achieved. We believe that Risk Sciences' suggestion that the "entire basin plan" would have to be brought back to the Regional Board for reconsideration in the event of USEPA's disapproval of this language is a misstatement; clearly, the basin plan as a whole would not be affected by this limited amendment to incorporate a TMDL.

Comment #11
Dry condition compliance depends on control over external loading during wet weather.

Response#11
As explained in the staff report, internal nutrient loads dominate during both dry and average hydrological conditions while external loads dominate during wet hydrological conditions. Since the hydraulic residence time of Big Bear Lake is approximately 11 years, any external loads deposited during wet hydrological conditions will likely be buried and/or recycled. Since the WASP lake model did not model lake water quality concentrations during wet hydrological conditions, the link between external and internal nutrient loads is only speculative. Only with further modeling and monitoring can this link be elucidated. This information is a required component of the implementation plan. Moreover, many researchers state that internal nutrient loads must first be controlled if these dominate because focusing only on external nutrient loads will not reduce internal nutrient loads. We have taken a similar approach with this TMDL.

Matt Yeager
San Bernardino County Flood Control District
(Comments presented orally on February 14, 2006)

Comment #1
Please be consistent with the use of eutrophic and moderately eutrophic in the Basin Plan amendment.

Response#1
Staff have changed eutrophic to moderately eutrophic in the Basin Plan amendment (page 2 of 21). The definitions of these are related to the trophic state index (explained in the Staff Report on the Nutrient TMDLs for Big Bear Lake (June 2005)) and are defined by the concentrations of total phosphorus, total nitrogen and chlorophyll *a,* as well as secchi depth.

Richard Kun
Snow Summit Ski Corporation
(Comments presented orally on February 14, 2006)

Comment #1
Both Bear Mountain and Snow Summit ski resorts apply calcium nitrate to the snow and not ammonium nitrate as reported in the Staff Report.

Response #1
Comment noted.

Comment #2
Snow Summit Ski Corporation is already regulated by the USFS, the City of Big Bear Lake and the County of San Bernardino. Why are we the only private corporation in Big Bear Lake that has been singled out?

Response #2
Snow Summit Ski Corporation has not been singled out but has been identified as one of the parties responsible for inputs of nutrients to Big Bear Lake. Similarly, the other parties identified by the commenter are responsible for nutrient inputs and are thus required by the proposed TMDL to assume specific implementation responsibilities. This is part of the requisite TMDL process of identifying significant sources of pollutants resulting in water quality standards impairment, and identifying appropriate actions to control those inputs.

Dave Smith
U.S. EPA
(Comments presented via teleconference on February 16, 2006 and via a letter dated February 23, 2006)

Comment #1
The TMDLs and associated allocations presented in the staff report may not result in attainment of the selected total nitrogen target. This issue must be addressed to ensure that the TMDLs are approvable under the Clean Water Act.

Response #1
As described in the Staff Report on the Nutrient TMDLs for Big Bear Lake (June 2005), staff attributes the inability to demonstrate the attainability of the nitrogen target to model limitations. However, to address the concern identified by USEPA, the proposed nitrogen numeric target, TMDL, WLAs and LAs have been deleted from the proposed Basin Plan amendment. The proposed amendment continues to include requirements for the collection of nitrogen data, which will be used to assess the need for and nature of revisions to the TMDL to include nitrogen targets, TMDL, etc., and to assess compliance with the established Total Inorganic Nitrogen objective for Big Bear. A description of this strategy has been added to the proposed amendment at Section 1. A. Numeric Targets.

Comment #2
Although we concur with the TMDL's focus on dry hydrological conditions and effects as the highest priority time period in terms of nutrient effects in the Lake, we are concerned that the staff report does not demonstrate that setting TMDLs and associated allocations that apply only during dry hydrological conditions will ensure WQSs are attained during all hydrological/climatic conditions. Based on the source assessment, it appears that substantial external nutrient loadings occur during wet conditions. A significant portion of wet condition nutrient loads are likely to remain in the Lake for an extended period of time, thus contributing to in-lake nutrient loading during dry conditions. To be approvable, the TMDLs must be set at levels that result in attainment of water quality standards during all hydrological/climatic conditions.

Response #2
Based on (1) the comparison of data collected in 2005 (a wet hydrological period) and data collected in 2001-2004 (a dry period) (shown below), (2) the linkage between decreases in total nitrogen and total phosphorus concentrations and increases in lake levels that would be expected in average/wet conditions (Anderson and Wakefield-Schmuck, 2006), and (3) evidence that nutrient fluxes occur from mineralization or release from surficial material, not from deeper sediments, staff believes that implementation of the proposed TMDL will assure compliance with the numeric targets and, thereby, water quality standards without external load reductions. This should not be construed to mean that external load reductions will not be required in future TMDLs developed to address average/wet hydrologic conditions, or that such reductions would be ineffective. The focus of the proposed TMDL is on reductions in the internal loading of sediments (including those that were deposited during wet conditions), since internal loading dominates during the critical dry conditions. Control actions to address internal

loads will need to be implemented. To the extent that internal sediment sources are reduced over the long-term by reducing external loads, then the burden of internal load reduction would be reduced. These findings are subject to confirmation as TMDLs for wet and/or average hydrological conditions are developed, as required by the proposed implementation plan. Language has been added to the discussion of the Big Bear Lake Nutrient TMDL in Section 1 of the Basin Plan Amendment and to the discussion of seasonal variation/critical conditions (Section 1. B. 3 of the Amendment) to clarify Board staff's expectation that since the proposed TMDL was developed to address the worst-case, critical conditions of dry periods, the targets are also expected to be met at other times, when there is additional inflow to Big Bear Lake and the volume of the lake and dilution are increased.

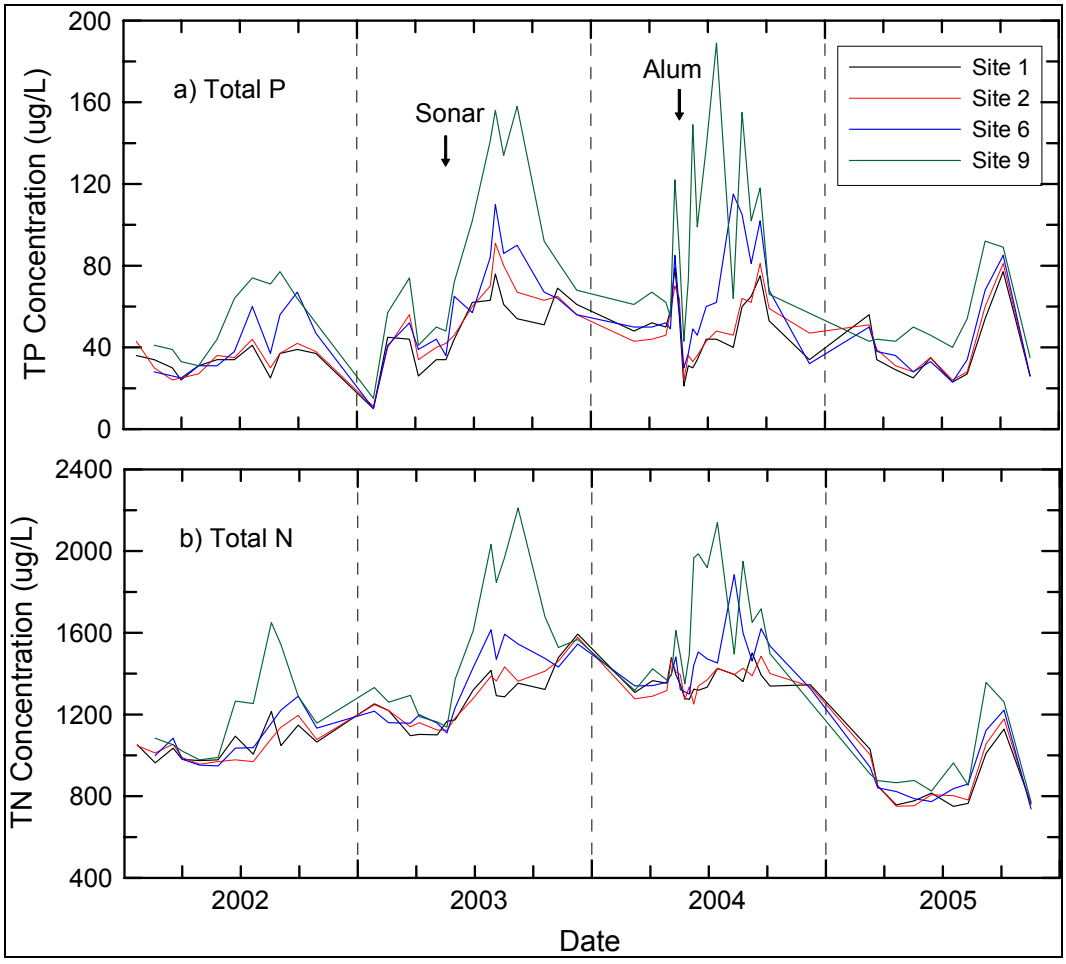


Figure 3. Total phosphorus (TP) and Total nitrogen (TN) concentrations from 2002-2005
Source: (Anderson and Wakefield-Schmuck, 2006)
Sites progress from west to east of the lake (Site 1 =west end; Site 9 = east end)

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